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## "ELECTRIC MAN" AND THE WORK OF BJÖRN NORDENSTRÖM

Andrew A. Marino, Ph.D.\*

### Introduction

Björn Nordenström was raised in a small city near the eastern coast of central Sweden, and received his medical training in Uppsala and Stockholm. He practiced radiology in Stockholm for more than 30 years, ultimately becoming chief of Diagnostic Radiology at the Karolinska Institute and Hospital. In his distinguished career he pioneered development of many important advances in diagnostic radiology including the use of radio-opaque dyes for the direct visualization of structural defects, balloon catheterization for improving the quality of radiographs, and the technique of percutaneous needle biopsy. Before Nordenström, the passage of a needle into the chest or peritoneal cavity to obtain a tissue sample for diagnosis was considered extremely dangerous and not worth the risk to the patient. Today, largely because of Nordenström, it is a common technique in routine use worldwide.

Despite his fundamental contributions to mainstream radiology, it is his work in bioelectricity that has attracted the most attention, and raised hopes and expectations. Beginning in the 1950's, Nordenström observed a specific radiographic image of pulmonary lesions which he termed the corona complex. The corona complex is defined in terms of radiologic signs, but it consists essentially of a series of columns, arches, and radiating fingers of tissue surrounding a lung tumor (1). Perhaps the most puzzling aspect

of the corona complex was the fact that it was not always present, even in successive monthly radiographs from the same patient. Nordenström observed the corona complex in about 30% of 7,000 cases, but not only in cancers – it also occurred around benign tumors and granulomas. Nordenström formulated a bioelectric theory to account for the origin and significance of the corona complex. The electrical potential of the tumor was theorized to oscillate between positive and negative values (relative to adjacent normal tissue) as part of the normal healing process, or in the case of a cancer, the body's attempt at healing. Nordenström linked various radiologic signs of the corona structure with these changes in electrical polarity of the lesion. In a long and sometimes loosely related series of laboratory and clinical studies, Nordenström presented some documentation for his theory of bioelectrical changes at the site of a lesion, and their relationship to radiologic signs (2).

Nordenström's next major conceptual step was to postulate that the electrical activity at the site of the lesion – which he identified with healing or attempted healing – could be artificially augmented by the clinician (3). This was to be accomplished by percutaneously placing an electrode in the tumor and making it electropositive (an anode), with the other electrode (cathode) needed to complete the electrical circuit placed somewhere in normal tissue. The presence of the anode in the tumor promoted the ionic flow between the tumor and the vascular system that was part of the normal healing response. The anode also promoted the influx of white blood cells into the area, and outflow of water from the lesion.

\* Department of Orthopaedic Surgery  
LSU School of Medicine  
P.O. Box 33932  
Shreveport, Louisiana 71130-3932

Nordenström's theory has now been tested on approximately 70 patients having inoperable tumors of the lung or breast (B. Nordenström, personal communication, 1987). In the first series of 20 cancers of the lung, 50 per cent of the cancers regressed or even disappeared completely. Perhaps even more remarkably, Nordenström's success came with a group of patients that had failed conventional therapy, and for whom there was no other rational alternative.

### **Nordenström's Research**

Nordenström's solitary research efforts are in marked contrast to the teams of experts that are typically organized to deal with problems of cancer etiology and therapy. Because he has worked alone, and because many of the details of his studies have not been published, there is uncertainty about Nordenström's work. His measurements of tumor potentials, for example, have not been adequately described. Such measurements are difficult to make without contaminating artifacts, and more evidence that such artifacts were not present will be needed before his work in that area gains wide acceptance. The exact relationship between the tumor potentials and the presence of the various radiologic signs also requires significantly more data to justify acceptance of a link between them. On the other hand, Nordenström's clinical results have been truly impressive, particularly considering the advanced state of the disease in essentially all of the patients that he treated. Thus, although it is far from certain that his bioelectrical treatments worked for the reasons that he has advanced, the treatments did bring about a therapeutic result in patients for whom there was essentially no alternative treatment. We must await a determination of whether Nordenström's therapy is effective in the hands of other clinicians, and we need further laboratory studies of the basis of its efficacy.

### **Is the Machine Electrical or Chemical?**

In 1980, over dinner, I asked Albert Szent-Györgyi, winner of the Nobel Prize in Medicine for his work on biological oxidation mechanisms and vitamin C, whether he thought that the healthy living state could be defined solely in biochemical terms. His answer was no, and when I asked him why, he thought for a moment and then mentioned as if he was holding a rat in each hand and said, "One is alive, one is dead, but the biochemicals are the same." Szent Györgyi's point was that the biochemicals were only the bricks of the living state, and that a presently unknown electrical factor was the mortar. The definition of a nutritionally ideal situation is exceedingly complex (4), but this complexity may be a result of modern science's failure to recognize and appreciate the role of electrophysiological factors that function at the systemic level and mediate the body's most fundamental processes – life and health. Perhaps the oscillating potential described by Nordenström at the site of a lesion is one such factor, and the failure to recognize it has led to the present confused state of cancer research. Systemic characteristics of the living state tend to remain unstudied because the presently popular strategy in biology consists of focusing on ever smaller sub-systems in an attempt to isolate a problem at a level where the investigator has increased control. If the problem is capable of a solution only at the level of the entire organism, then its solution will simply have to await a day when research fashion changes. Growth and healing are systemic manifestations of the living state that seem particularly immune to an approach based strictly on biochemistry. The nature of pain, memory, and sensitivity to external electromagnetic fields are still other examples. The question I posed to Szent-Györgyi – what is the physical basis of life? – is perhaps the ultimate example. Success with these prob-

lems likely will come only after elucidation of some of the relevant electrophysiological variables that govern and mediate the processes. Nordenström's work with one systemically important electrophysiological factor is important in its own right, but also because it promotes interest in bioelectricity, thereby attracting the scientists whose efforts may lead to solutions of many of the present problems in clinical medicine and nutrition.

### References

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